The Effects of a Child-Controlled Robot on Maternal Conversational Dominance During Play: A Case Study

Kathryn Sirard and Amy Wainer

Supervisor: Dr. Kim Adams

Reader: Adriana Rios

Second Reader: Dr. Albert Cook

Short Title: Maternal conversational dominance during play

ABSTRACT

Previous research has indicated parents of children with cerebral palsy and other complex communication difficulties exhibit high levels of control during communication exchanges. The current study investigated differences in maternal communication with a child with complex communication deficits in two free play sessions. During the first play session, referred to as the No Robot session, the child and her mother played with a set of toys provided by the researchers. The second free play session, referred to as the Robot condition, incorporated a means for the child to actively participate in the interactions, in that the child controlled a Lego RCX Mindstorm™ robot, operated by using three switches. The mother's utterances were coded in each of the play sessions and analyzed for features of conversational dominance. The researchers predicted that the mother would demonstrate decreases in Yes/No and Open-Ended Questions, decreases in Direction of Action, and decreases in Direction of Attention in the Robot condition as compared to the No Robot condition. Results indicate that the mother's rate of question-asking decreased in the play session with the robot. The mother also showed decreases in statements of Direction of Attention in the robot condition. Contrary to the researchers' hypothesis, the mother increased her use of statements of Direction of Action in the play session with the robot. Overall, the mother did show evidence of changing her conversational style when her child was afforded a more active role in free play sessions.

INTRODUCTION

Cerebral palsy (CP) is a neurological condition caused by brain injury that occurs before cerebral development is complete (Krigger, 2006). The presentation of CP is highly variable; individuals may present with global mental and physical dysfunction or isolated disturbances in mobility, cognition, or sensation (Krigger, 2006). Communication in individuals with CP may be impacted for a variety of reasons. For example, cognitive difficulties may restrict a child's understanding of language. As well, children with CP often have impaired oral motor functioning, making their speech difficult to understand. Children may not be able to produce consistent and easily understood vocalizations, making it difficult for others to interpret their communicative attempts (Pennington & McConachie, 2001). These communication barriers often lead to parents of children with CP adjusting their communication style when interacting with their children.

In the field of general infant development, Goldberg (1975) put forth a hypothesis regarding readability. She defined readability as "the extent to which an infant's behaviours are clearly defined and provide distinctive signals and cues for adults" (Goldberg, 1977 p. 171). The readability hypothesis posits that infants that are highly readable create a strong bond with their parents and primary caregivers, because their needs are easily communicated and subsequently met (Goldberg, 1977). This hypothesis may be applied to the relationship between children with CP and their primary caregivers. Children who are nonverbal, or have limited intelligible vocalizations and gestures may not be able to communicate their wants and needs in a consistent manner, and parents may have difficulty interpreting the communication attempts made by their children (Pennington & McConachie, 2001). In order to overcome this, parents may tailor interactions with their children with complex communication difficulties in order to ensure they understand their child's signals (Pennington & McConachie, 2001). For example, parents may primarily engage in communication situations in which the child is simply expected to provide a response of "yes" or "no." However, this modification may be very limiting, and children may fail to develop use of a variety of communication functions.

Children with motor delays associated with CP may be exposed to more commands and directives than their typically developing peers, as parents may communicate with an authoritative style while assisting their children in physical activities (Pennington & McConachie, 2001). As this conversation style becomes more practiced and ingrained, parents may carry over use of commands to more general conversation with their children. As a result, parents of children with complex motor and communication difficulties develop general patterns of conversational dominance when interacting with their children (Pennington & McConachie, 2001).

Previous research has investigated communication patterns and conversational dominance between children with CP and their primary caregivers. Pennington and McConachie (1999) investigated maternal conversational dominance between mothers and children aged 2-10 with CP. Video-taped interactions revealed mothers typically produced high proportions of conversation initiations and follow-up moves, meaning they began conversations and often made follow-up comments to their own initiations. Conversely, children produced very few initiations, and had higher levels of responses, meaning they tended not to begin conversations, but were able to respond when a topic was introduced. Communication was further analyzed according to function, or intention of the speaker.

Interestingly, mothers typically included multiple communication functions within one conversational move (or “turn” in the interaction), whereas children’s conversational move generally contained a single function. Mothers most frequently used the functions “request for information,” “request for object/action” and “provision of information.” This means mothers frequently asked their children questions and directed their children’s movements and actions. The communication function children used most often fell under the category of “confirmation/denial.” While this is an essential part of communication, contributions of “yes” and “no” generally do not advance a conversational topic in a meaningful way. When taken together, these results suggest maternal dominance was evident in the interactions between mothers and their children, as mothers tended to start most of the interactions, and also tended to end an exchange without any input from the child.

Later research expanded on the communication interactions between mothers and children by also investigating the effect of children’s intelligibility on conversational dominance. Research by Pennington and McConachie (2001) once again focused on interactions between mothers and children with CP, but the participants were divided into two groups: children whose vocalizations were unintelligible to their primary caregivers, and children who were intelligible to familiar adults. Conversation patterns were quite similar to their previous findings: mothers in both groups contributed high levels of initiations and were responsible for changing the topic of conversation, and children in both groups produced more responses than initiations. The readability hypothesis was supported, in that less intelligible children produced fewer communicative functions (confirmation/denial, request for attention, self-expression, etc.) than children who were capable of producing intelligible utterances. As well, mothers of children with unintelligible speech used proportionately more initiations as compared to the other mothers, furthering support for the readability hypothesis.

Sandberg and Liliedahl (2008) examined patterns of interaction between children with complex motor and communication difficulties and their mothers. Participants included a group of younger children between the ages of 2-3 years and their mothers, as well as a developmentally age-matched control group of typically developing children and their mothers. Analysis of videotaped play sessions revealed mothers of children with disabilities were more active partners during the interactions with their children than mothers in the control group. Mothers of children with disabilities often asked their children questions, and then responded to their own questions without waiting for their child’s response. They also contributed many more initiations than mothers in the control group did. Interestingly, the typically developing children in the control group made more initiations than their mothers, indicating they had a more balanced role in conversations as compared to the children with disabilities. When taken together, previous research examining communication patterns of mothers and children with complex communication difficulties show a distinct pattern of maternal dominance.

Given the high levels of dominance experienced by children with CP, it is crucial to afford these children with opportunities to exert independence during play and other daily activities. One approach to foster independence in this population is through the use and manipulation of robots. Through exploration of their environment and use of tools, typically developing infants and toddlers are able to demonstrate cognitive problem-solving skills (McCarty, Clinton, & Chollard, 2001). Children with motor impairments may have difficulty with manipulation of objects. As a result, they may have limited opportunities to demonstrate their cognitive skills, thereby affecting their participation levels in play activities and social interactions (Cook, Adams, Encarnacao, & Alvarez, 2012). Allowing children the opportunity to use modified remote-controlled robots using a series of switches allows children a chance to play independently, without relying on a parent or peer to direct the play activity. Using a robot, children with complex motor and communication difficulties are able demonstrate communicative and cognitive skills during educational or play activities (Cook et al., 2012).

In a study designed to assess physically disabled children's ability to engage in functional play activities, a robot that was programmed to perform a sequenced routine using a series of switches was placed in a school setting (Cook, Bentz, Harbottle, Lynch, & Miller, 2005). Students aged 6-14 with complex communication and motor difficulties were grouped by cognitive level. The students used the robot over a four-week period. Results indicated students in all three groups were able to demonstrate skills that carried over into classroom activities. Teachers reported students had increased vocalizations, increased interactions between participants and their classmates, and more attention to activities in the classroom following use of the robot (Cook et al., 2005). Through the use of a robot, students were able to successfully demonstrate independence and a range of cognitive skills. When taken together, the results of the preceding studies indicate that using robots may provide children with disabilities previously unexplored opportunities to demonstrate their cognitive skills. Parents and primary caregivers may observe cognitive skills in their children that were not previously demonstrated. In turn, recognition of these skills may lead to a change in primary caregivers' interaction style when communicating with their children with disabilities. Parents could exhibit less dominating conversation styles with fewer directive statements if they view their children as having an equal role in the conversation.

The purpose of the current research was to investigate differences in maternal communication with a child with complex communication deficits in an unstructured play session with and without the use of a child-controlled robot. Specifically, the study examined whether providing the child with a means to participate actively in the interaction (through manipulation of the robot) would affect the communicative functions used by the mother. It was predicted that the mother's communication functions would change with the presence of the robot to reflect the child's more active role in the play session. The biggest differences were expected in the categories of question asking and use of directive statements, as previous research has indicated these communicative functions significantly contribute to conversational dominance. Specifically, in the play session with the robot, as compared to the play session without the robot, the researchers predicted the following differences in the mother's communication:

- decreases in the yes/no and open-ended questions functions
- decreases in "direction of attention" function
- decreases in "direction of action" function

METHODS

Participants

The participant in the present study consisted of a seven-year-old child with spastic cerebral palsy and her mother. The child had severe motor and communication difficulties and was able to produce limited verbal utterances. She was able only to say "yes" and "no". The participants live in Colombia, meaning interactions between the participants occurred in their native language of Spanish.

Materials

The materials for the study included a range of toys provided by the participants, a Lego RCX Mindstorm™ robot, and an adapted Lego robot infrared controller, operated by using three switches.

Procedure

Interactions between the mother and child were videotaped in free-play sessions, occurring one week apart. During the first play session, the child and her mother played with a set of toys provided by the researchers, which were displayed on the home dining table. The mother was instructed to interact with her child as she typically would during playtime. As this first play session did not involve the Lego robot, this session was referred to as the *No Robot* condition. Following this *No Robot* session, the participant took part in a separate robot study comprised of two assessment sessions wherein the child's cognitive skills for operating the robot were evaluated (Cook, Encarnacao, Adams, Alvarez, & Rios, 2012). During these assessment sessions the researchers provided some prompting to the girl. The second free-play session occurred immediately after the second assessment session. During the second free-play session, the mother and child played with the same set of toys as well as with the robot. The girl was sitting in her wheelchair and had three switches on a wheelchair lap tray for operating the robot. This second play session was therefore referred to as the *Robot* condition. Again, the mother was instructed to interact with her child as she typically would while playing with her daughter. The No-Robot session lasted 14:17 minutes, and the Robot session lasted 11:23 minutes.

Data Collection

The total number and communication function of the mother's utterances and the total number of child's verbal utterances were coded in order to investigate the effect of the robot on maternal communication.

***Development of Coding System*.** The researchers considered using a previously published coding system to analyze each videotaped session, that of Clarke and Kirton (2003). The coding system outlined by Clarke and Kirton (2003) contains three levels of analysis: conversational moves, communicative functions, and mode. Conversational acts are classified into moves such as initiation, response, response/initiation, follow-up follow-up/initiation, and no response. Each act is further categorized based on communicative function, reflecting the purpose of the communicative act. Each communicative function is further categorized according to communicative mode, reflecting the manner in which the acts were communicated, including verbal, vocalization, gesture, and communication aid (Clarke & Kirton, 2003).

The purpose of the study where Clarke and Kirton (2003) used the coding scheme was to investigate interactions between children with physical disabilities and their peers, meaning the analysis focused on both sides of the communicative exchange. However, the purpose of the current study was to investigate maternal dominance, and need only focus only on the mother's contributions during the play sessions. Thus, Clarke and Kirton's coding system was deemed too complex to apply for our research purposes and the researchers modified the original coding system to make it more applicable to the current project.

Analysis of moves was excluded from the current study as the researches focused on the mother's utterances during the play sessions. Furthermore, analysis of communicative mode was also excluded, as cultural differences and a language barrier excluded the monolingual English-speaking researchers from adequately interpreting all the nuances incorporated in nonverbal communication.

The researchers made modifications to the original communicative functions published by Clarke and Kirton (2003). For example, some communicative functions included in the original coding system were deemed not applicable to the current data set. In addition, the researchers aimed to investigate functions that were not included, or not included in as much depth, in the system published by Clarke and Kirton (2003). As a result, some categories the researchers deemed not applicable were collapsed, and some categories of particular interest to note observable changes were expanded upon. For the communicative functions in the original coding system as well as the modifications made to fit the current data set, please see Appendix 1.

Application of Coding System. A native Spanish speaker translated the mother's utterances and occurrences when the child said "yes" or "no" in each play session from Spanish to English. The researchers coded from printed English transcripts. Data coding consisted of categorizing each of the mother's utterances according its communicative function. Each utterance was coded as a single function. Thus, in cases where more than one communicative function could be applied to a single utterance, the communicative function was coded according to the overall, primary communicative intent of the utterance. As an example, consider the following utterance:

"Look at this, do you like it?"

This utterance could be coded as either a direction of attention ("Look at this") or a yes/no question ("do you like it?"). However, the goal of this communicative utterance was deemed to be establishing whether or not the child likes the toy (through asking the yes/no question), and not simply to direct the child's attention to the toy. As a result, the primary communicative function of this utterance was coded as a yes/no question.

The researchers coded the video transcripts individually at first but when utterances were unclear, or could be assigned more than one function, the researchers conferred until consensus was reached. After coding was completed for each transcript, the researchers reviewed their entire list of codes to ensure consistency.

Data Analysis

Since the purpose of the current study was to investigate maternal communication, only the communicative functions that denote conversational dominance (e.g., directive statements and questions) were included in the data analysis. More specifically, the researchers analyzed differences in the mother's use of Yes/No and Open-Ended questions, Direction of Attention, and Direction of Action between the play sessions with and without the use of a robot.

The researchers also collected the number of verbal utterances made by the child during the play sessions. The child's verbal output was limited to responding "yes" or "no", therefore it was not necessary to code the communicative function of these utterances.

RESULTS

The rate per minute of each of the functions was calculated. This was to control for the difference in length of time of the videos of the two conditions.

Questions

Table 1 shows the absolute number, rate, and percentage of Yes/No and Open-Ended questions in both the Robot and No Robot Conditions, as well as the change in questions between the two conditions.

Table 1: *Yes/No and Open-Ended Questions in Each Condition*

	NO ROBOT			ROBOT				
	Absolute Number	**Rate (per min)**	**Percentage**	**Absolute Number**	**Rate (per min)**	**Percentage**	**Change in rate (Robot- No Robot)**	**Percent Change**
Question- Open Ended	29	2.03	41.4%	16	1.41	31.4%	-0.62	-30.5%
Question- Yes/No	41	2.87	58.6%	35	3.08	68.6%	+0.21	+7.3%
Questions-Total	70	4.90	100%	51	4.49	100%	-0.407	-8.4%

Directive Statements

Table 2 shows the absolute number, rate, and percentage of the functions “direction of action” and “direction of attention” in both the Robot and No Robot Conditions, as well as the change in these directions between the two conditions.

Table 2: *Direction of Action and Direction of Attention in the No Robot and Robot Conditions.*

	NO ROBOT			ROBOT				
	Absolute Number	**Rate (per min)**	**Percentage**	**Absolute Number**	**Rate (per min)**	**Percentage**	**Change in rate (Robot- No Robot)**	**Percent Change**
Direction of Action	23	1.61	37.7%	37	3.26	67.3%	+1.65	+102.5%
Direction of Attention	38	2.66	62.3%	18	1.59	32.8%	-1.07	-40.2%
Directions-Total	61	4.27	100%	55	4.84	100%	+0.575	+13.3%

Verbal Utterances Made by the Child

Table 3 shows the absolute number and rate of verbal utterances made by the child in the No Robot and Robot condition, as well as the change between the two conditions.

Table 3: *Absolute Number and Rate of Verbal Utterances Made by the Child in the No Robot and Robot Conditions.*

	NO ROBOT		ROBOT			
	Absolute Number	**Rate (per min)**	**Absolute Number**	**Rate (per min)**	**Change in rate (Robot-No Robot)**	**Percent Change**
Child Utterances	27.00	1.89	48.00	4.23	2.34	+123.8%

DISCUSSION

As predicted by the first hypothesis, the rate of questions decreased from the No Robot condition to the Robot condition. Specifically, the overall rate of questions decreased by about 8% in the Robot condition as compared to the No Robot condition. In looking at the types of questions asked, the rate of Open-Ended questions decreased by about 30%, whereas the rate of Yes/No Questions actually increased by about 7%. Therefore, the mother asked far fewer Open-Ended questions and more Yes/No questions in the Robot condition as compared to the No Robot condition. In both the No Robot and the Robot conditions, the majority of questions were Yes/No questions, which suggests the mother is still being directive in the conversation.

As predicted by the second hypothesis, the rate of Direction of Attention decreased from the No Robot condition to the Robot Condition. Specifically, the rate of Direction of Attention was approximately 40% lower in the Robot condition as compared to the No Robot condition. This may reflect the fact that the child was actively engaged in the task at hand (controlling the robot), so the mother did not feel the need to tell the child where to pay attention as frequently.

In contrast to the third and final hypothesis, the rate of Direction of Action actually increased in the Robot condition as compared to the No Robot condition. In fact, the rate of Direction of Action in the Robot condition was almost twice that of the No Robot condition. This suggests that the mother was actually being much more directive in the Robot condition than in the No Robot condition. This can at least be partially explained by the very presence of the robot, which was controlled by the child. The robot provided the child with a level of activity that was not possible in the No Robot condition. Thus, there were likely far greater opportunities for the mother to direct the child's action in the Robot condition than in the No Robot condition, as the child was more active.

It is likely that the increase in Direction of Action statements in the Robot condition reflects the mother making directive statements regarding how the child should control the robot. This implies that the mother is still being quite directive. The child is influencing some control over the situation, as she is the one in charge of the motion of the robot. The child is the one controlling the movement of the robot, however, the mother may still be trying to exert control through her instructions. Therefore, the mother may have adapted her communication such that she is still exerting control. However, it is also possible that the mother was providing the child with instructions as to how to direct the robot because the child did not have an adequate understanding of how to control the robot. Given that analysis was based on printed transcripts, and therefore does not contain the context surrounding the exchange, it is difficult to speculate about the mother's true intent in making these comments. Ideally, the child's performance in the assessment sessions where the child's cognitive skills for operating the robot were evaluated should be available (Cook, Encarnacao, Adams, Alvarez, &

Rios, 2012). Knowing this could help clarify whether the mother's Direction of Action statements were necessary due to the child's lack of knowledge of the robot controls. If she did not have mastery, then incorporating a training session addressing the robot controls could ensure that the child has adequate robot control skills before progressing to the second free-play session.

However, it is still worthwhile to note that even though the mother is still attempting to control the situation, the dynamic between in the mother-child dyad changed. The fact that the mother was attempting to direct the action of the robot, which was controlled by the child, means that the topic of conversation was centered around the action of the child and the robot. This therefore implies that the mother is responding to the action of the child, at least in some way. While the mother is still exerting high levels of control in the conversation, one could argue that the child is more of a participant in the conversation in the Robot condition because the mother was at least responding to the child's actions. In the No Robot condition, the mother was almost exclusively in control of the conversation—determining the topic of the conversation, and when the conversation began and ended. The child had very little control in the conversation at all. In the Robot condition, the child was influencing the topic of conversation by controlling the robot. Even though the mother was still controlling the verbal conversation, she was not the only one in control of the *topic* of the conversation

The decrease in the rate of Direction of Attention in the Robot condition could be reflective of this as well. The mother could be said to be controlling the topic of conversation less, as she is directing the child's attention towards different objects less often. Instead, the topic of conversation remained focused around the child's actions via using the robot. Perhaps the mother made less Direction of Attention statements because the perceived need for such statements decreased as both mother and child were often jointly attending to the robot. Controlling the robot likely provided an alternate means for the child to participate in the conversation, albeit indirectly.

Overall, the mother's interaction style was consistent with previous literature suggesting a high level of conversational control (Pennington & McConachie, 1999; Sandberg & Liliedahl, 2008; Pennington & McConachie, 2001;), as there were high levels of request for joint attention and requests for actions. In fact, together, Direction of Action and Direction of Attention made up approximately 34% of the mother's utterances in the No Robot condition, and about 40% of the mother's utterances in the Robot condition. This suggests a high level of conversational control.

Although changes in the child's verbal communication following the introduction of the robot were not the focus of this study, it is nonetheless worth noting that the child's rate of verbal utterances increased by more than 120% from the No Robot condition to the Robot condition. Delving into the underlying reason why this change occurred is beyond the scope of the current project and could be the focus of future research. Perhaps the child's increase in verbal yes/no answers is related to the increase in yes/no questions asked by the mother, or perhaps it is reflective of an overall increase in the child's participation in the conversation. Further research, likely incorporating the child's nonverbal communication, is required to further explore this.

Limitations

One limitation of this study is the focus on only the verbal communication between the mother and child, and not non-verbal communication. Non-verbal communication can be quite subtle and many aspects can vary across cultures. Also, since this case-study was an exploratory study with a novel coding paradigm, it was decided to only apply the newly developed coding system to the mother's verbal communication. As a result, our data do not include any nonverbal communication attempts made by either the mother or the child.

This study compared only the communicative functions that were considered to be indicative of a dominating communication style, and did not evaluate *all* the communicative functions expressed by the mother. This was appropriate to the purpose of the research (examining mother's conversational dominance), however, evaluating the mother's use of a wide range of communicative functions would paint a more complete picture of the communication pattern between the mother and child.

Future Directions

The present case-study was exploratory in nature, therefore repeating the study with a larger sample would be valuable. A larger sample size would allow for statistical analyses of the impact of a child-controlled robot on the communication between mother-child dyads.

Nonverbal communication should be included in future research. Including both verbal and non-verbal communication would reflect a more complete picture of the mother's communication, and would also allow for an evaluation of communicative functions expressed by the *child.* This would provide a more detailed description of mother-child communication during play and the subsequent impact of introducing a child-controlled robot.

Summary

The purpose of the current case-study was to evaluate the impact of a child-controlled robot on maternal communication with a child with complex communication deficits in an unstructured play session. The rate of utterances with an "open-ended question" function or a "direction of attention" function both decreased following the introduction of the robot. The rate of statements including a "yes/no question" function or a "direction of action" function both increased in the presence of the robot. These changes support the general hypothesis that the mother's overall communicative functions would change following the introduction of the child-controlled robot.

REFERENCES

Clarke, M. & Kirton, A. (2003). Patterns of interaction between children with physical disabilities using augmentative and alternative communication systems and their peers. *Child Language Teaching and Therapy, 19*(2), 135-151.

Cook, A.M., Adams, K., Encarnacao, P., & Alvarez, L. (2012). The role of assisted manipulation in cognitive development. *Developmental Neurorehabilitation, 15*(2), 136-148.

Cook, A.M., Bentz, B., Harbottle, N., Lynch, C., & Miller, B. (2005). School-based use of a robotic arm system by children with disabilities. *IEEE Transactions of Neural Systems and Rehabilitation Engineering, 13*(4) 452-460.

Cook, A.M., Encarnacao, P., Adams, K., Alvarez, L., & Rios, A, editors (2012). Cross-cultural use of physical and virtual robots reveal cognitive understanding in young children. Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Conference; Baltimore, MD

Goldberg, S. (1977). Social competence in infancy: A model of parent-child interaction. *Merrill-Palmer Quarterly of Behavior and Development, 23*(3), 163-177.

Krigger, K. W. (2006). Cerebreal Palsy: An overview. *American Family Physician*, *73*, 91-100.

McCarty, M., Clifton, R., & Chollard, R. (2001). The beginnings of tool use in infants and toddlers. *Infancy, 2*, 233-256.

Pennington, L. & McConachie, H. (1999). Mother-child interaction revisited: Communication with non-speaking physically disabled children. *International Journal of Language and Communication Disorders, 34* (4), 391-416.

Pennington, L. & McConachie, H. (2001). Interaction between children with cerebral palsy and their mothers: The effects of speech intelligibility. *International Journal of Language and Communication Disorders, 36* (3), 371-393.

Sandberg, A.D., & Liliedahl, M. (2008). Patterns in early interaction between young preschool children with severe speech and physical impairments and their parents. *Child Language Teaching and Therapy, 24*(1), 9-30.

APPENDIX

Appendix 1: *Side-by-side comparison between coding system developed by Clarke & Kirton (2003) with adapted coding system used in present study.*

Original Clarke & Kirton Coding System	**Modified Coding System used in current study**
Request for Joint Attention (RJA) o Requires the listener to look at or listen to the speaker or look at the object referred to by the speaker	Direction of Attention (DAT) o Directing the listener’s attention to an object, location etc. o Examples: ‘Look at this’ or ‘look at the toys’
Request for Information (RI) o Elicits a response from the listener and includes closed and open questions, and requests for permission	Yes/no Question (QYN) o A question that can be answered by ‘yes’ or ‘no’
	Open-ended Question (QOE) o A question that cannot be answered by a yes’ or ‘no’
Request for Object/Action (ROA) o Speaker expresses the desire for an object or physical action	Direction of Action (DAC) o Comments made instructing the listener to perform an action o Example: ‘hold this’ or ‘take the ball’
Request for Clarification o (Confirmation (RCC), Neutral Request (RCN), Specific Request (RCS)) o Speaker expresses they have not understood the previous message and require clarification o all or part of the previous message is repeated o prompts to speaker to repeat the utterance, such as “what?” or “I don’t understand” o prompts repetition or rephrasing of part of the message, asking about a detail within the message	Request for Clarification/Confirmation (REQ) o Asking the listener to clarify what was previously said. o OR confirming that the listener correctly understood the speakers intended meaning
Provision of Information(PI) o Comments about objects, actions, internal states, and answers to requests for information	Comment-Label/Noun (CNL) o Comments that identify or list objects/toys/items
	Comment-Verbs/Action (CVL) o Comments describing the speakers’ or listeners’ actions
	Response-to open-ended question (ROE) o An appropriate answer to an open ended question

Provision of Clarification
o (Revision (PCREV), Repetition (PCREP))
o Speaker clarifies a previous utterance
    o content or mode used to clarify differs from the original message
    o an exact repetition of the original message
	Repetition of previous remark (REP)
	o Repeating a previous statement, comment, or question
	o Must occur in back-to-back turns
	“look at the toy” (dir. of attn.) “look at the toy” (repetition)

Self or Shared Expression (SSE) o Demonstrates the speaker’s personality or emotional state and includes expression of feelings such as pleasure, anger, and expression of humour. It does not add any additional information	Self or shared expression(SSE) o Expressions of emotional state o Example: laughter, smiling, crying, smiling

Acknowledgement (ACK) ○ A response to a previous utterance or action. It does not provide any additional information to the conversation, but may convey or confirm understanding of the previous utterance	N/A
Confirmation/Denial (CD) ○ Can be an affirmation, agreement, rejection, or disagreement	Confirmation/Denial (CON or DEN, respectively) ○ A 'yes' or 'no' response (verbal or nonverbal)
Unintelligible or Uncodeable (UNINTELL) ○ Utterances that have no interpretable meaning to the coder or listener	N/A
N/A	Speaking on behalf of child (OBC) ○ Indicates an utterance made on behalf of the child. This includes cases when the child does not respond to a question, and the speaker subsequently provides an answer themselves.
N/A	Positive Reinforcement (POS) ○ Praise or other forms of positive reinforcement ○ E.g., "good job!"

Note: when possible, the functions used in the modified coding system appear beside the original function as defined by Clarke & Kirton (2003).